

Occlusal caries: Diagnosis and noninvasive treatments

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The diagnosis of occlusal caries and the initiation of more effective treatment present a considerable challenge. Caries not only has decreased in prevalence, but also has changed in pattern and in progression because of the increased use of fluorides. Correct diagnosis is crucial, distinguishing lesions that can be arrested by noninvasive treatment from those that may justify restorative treatment. For incipient lesions, it is necessary to improve the patient's home care preventive methods, to apply fluoride or other prophylactic agents, or even to seal fissures, preserving the maximum amount of sound tooth structure. This article discusses the diagnosis of occlusal caries and noninvasive treatments for the management of early caries. (Quintessence Int 1999;30:174-178)

Key words: arrested lesion, caries diagnosis, incipient lesion, noninvasive treatment, occlusal caries

CLINICAL RELEVANCE: Precise diagnostic methods are important for deciding whether to treat a particular lesion. Noninvasive treatments are preferable in early lesions.

The continued decrease in the prevalence of dental caries requires much greater caution on the part of the clinician and a greater focus on accurate diagnosis of caries status and risk factors associated with the formation of new lesions and the progression of existing lesions.¹ Furthermore, caries not only has decreased in prevalence, but also has changed in pattern and progression.² The increased use of fluorides is thought by many to be largely responsible for this changing pattern of dental caries, an additional benefit being conferred on those who have had lifelong exposure to water fluoridation.³

The problems in caries diagnosis are usually not associated with advanced lesions (Fig 1), but primarily involve the early lesions (those confined to the enamel).⁴ It has been suggested that the diagnosis of fissure caries has become more difficult because the high remineralization capacity of fluorides tends to mask dentinal caries.⁵⁻⁷

"Questionable" occlusal caries appears to be particularly difficult to diagnose and to treat if the dentist's goal is conservative dentistry. For lesions in enamel, treatment consists of improvement in the patient's home care preventive methods, application of fluoride or other prophylactic agents, or sealing the fissures. Sometimes it is only necessary to practice "watchful waiting."⁸ These procedures are a part of the conservative philosophy (noninvasive treatments), which contrasts with the invasive philosophy, which does not eliminate the disease and just treats the disease symptoms.⁹

The purpose of this article is to discuss the diagnosis of occlusal caries and noninvasive treatments for the management of early caries.

DIAGNOSIS OF OCCLUSAL CARIES

The diagnosis of occlusal caries presents a considerable challenge. That is why it is important to diagnose correctly, distinguishing lesions that must be treated restoratively from those that can be treated in a noninvasive way. This procedure is difficult because of the

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Fig 1 Obvious cavitated lesion in an occlusal surface. The diagnosis of caries is evident, and restorative treatment is necessary.

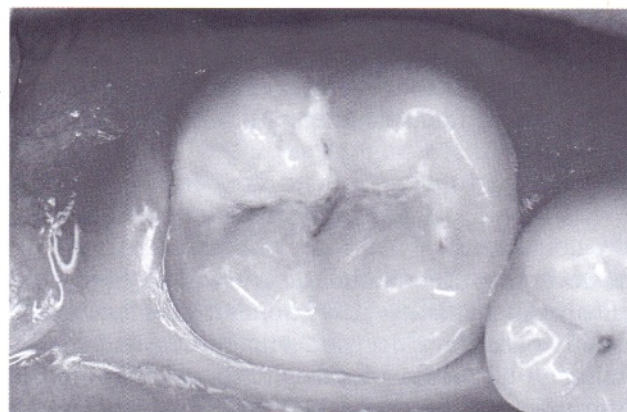


Fig 2 Early caries in an occlusal surface. The white-spot lesion and the brown discoloration in the fissure indicate that demineralization of the enamel has occurred. Bitewing radiography showed no radiolucency in dentin.

dynamic nature of dental caries, which includes periods of demineralization and remineralization, meaning that the detection of small lesions is particularly important.⁵

Visual inspection

Early caries in occlusal surfaces usually appears as a white-spot lesion, with brown discoloration around the fissure, suggesting that demineralization of the enamel has occurred (Fig 2). Compared to translucent sound enamel, white spots are opaque because their crystals have changed physical properties and have a different chemical makeup. White spots can be seen around the opening of an occlusal fissure, and they may have a matte or dull appearance, indicating active disease.¹⁰ Alternatively, fissures may be stained, and this appearance may or may not indicate a carious lesion. The area of enamel around the fissure may also appear opaque or may have a grayish tinge indicative of stained dentinal caries.⁵ Sometimes early stages of the lesion are hidden from the naked eye, with large dentinal lesions—beneath seemingly sound occlusal surfaces^{7,11,12}—that may justify restorative treatment.

In arrested lesions, remineralizing phases have exceeded demineralizing phases. Fluoride ions and other minerals have been incorporated in the lesion as part of the consolidation process. A darker discoloration can be seen in arrested lesions as a result of the extrinsic organic material incorporated, and these areas are more resistant to cariogenic challenge.^{13,14} This situation can be addressed by noninvasive treatments that can enhance this process.

Caries can be diagnosed by visual inspection. A probe should be used only for careful removal of debris from the depths of the fissure.¹⁰ Probing may allow

transmission of cariogenic flora from one infected site to another. Furthermore, it can produce irreversible traumatic defects in potentially remineralizable enamel, and probing is not more accurate in diagnosis than visual inspection alone.^{4,5,15,16} Because of the possibility of introducing iatrogenic damage, there is reason to reconsider the probe as a classic invasive method of diagnosis.¹⁶

Then, the concept of “looking for” caries with the eyes is very important.³ To allow reliable detection of the earliest, clinically visible, manifestation of dental caries—the white spot, teeth should be clean and dry.⁵ Plaque and saliva can obscure these lesions,⁵ and clinicians working at the cavitation level are more likely to make false negative diagnoses, missing active caries that could be arrested. In addition, the white spot is more obvious when teeth are dry because of the different refractive indices of enamel, water, and air.¹⁷ The refractive index of enamel is 1.62. When demineralized, enamel becomes porous. If the teeth are wet, these pores are filled with a watery medium with a refractive index of 1.33; when the porosity is considerable, this difference in refractive index will cause the tissue to lose its translucence and appear opaque. If the enamel is dried, the water is replaced with air, which has a refractive index of 1.0: the difference in refractive index between the air and the enamel is greater than that between water and enamel, so the lesion is more obvious.

When assessing a carious lesion, the dentist should first ask, “Is there active caries?” instead of, “Is there caries?”³ Many times, lesions can be arrested if a concept of treating these diseases as infections rather than just treating the disease symptoms is adopted.⁹ The concept of “lesion behavior” rather than “lesion progression,” now seems more logical because it

avoids any implication of unavoidable and unremitting activity.¹⁸ Thus, dentists can apply more efficient and realistic methods for better patient care and treatment based on the identification of caries risk or caries activity.¹⁹

Patient history

However, dentists continue, currently, to have difficulty in differentiating active from arrested lesions and usually base their decision on "clinical judgment." Failure to diagnose caries may result in the continued destruction of the dentition.¹² To help in their decisions, they should include in the patient's record an assessment of the past caries experience and caries risk. They should know the patient's dietary habits, salivary function, plaque localization and consistency, pit and fissure morphology, and home care preventive methods (exposure to fluoride, for example).⁴ This status will identify the rate of caries progression and the necessity of monitoring caries activity.¹⁵

Bitewing radiographs

Because no better method for determining the presence and extent of occlusal caries has been developed, it is useful to include information obtained from bitewing radiographs in the diagnosis of occlusal caries.⁶ Radiographs are better than visual inspection alone,¹¹ because clinical scoring most frequently underestimates lesion depth.^{20,21} However, the anatomy of posterior teeth is such that large volumes of sound enamel cover the buccal and lingual cusps and, on a radiograph, conspire to mask any incipient demineralization in an occlusal fissure.¹¹ There is a higher frequency of false-positive diagnosis in the occlusal area than in the interproximal area, indicating that the borderline between enamel and dentin is difficult to interpret radiographically.²¹ The most dramatic clinical consequence is when restorations are placed in sound teeth.

An occlusal radiolucency in the bitewing radiograph calls for attention, constituting a valuable supplement to the clinical examination,⁷ and a restorative technique is considered necessary when a lesion extends into dentin.²²⁻²⁵ However, it is not possible to correlate external characteristics, such as where the caries occurred on the tooth surface, lesion color, presence of shadowing, or the fissure morphology, with the extent of the carious process.²³ Radiographs are inaccurate in estimating the extent of the caries or in detecting minimal occlusal lesions but are useful for monitoring the preventive therapy.¹² This vigilance is necessary to accomplish the ultimate goal of dentistry: to conserve as much tooth structure as possible.²⁴

In conclusion, the modern clinician's aim should be to diagnose caries before cavitation has occurred so that noninvasive treatments may arrest it. To this end, the clinician should examine clean, dry, and well-lighted teeth by visual inspection and bitewing radiographs.

NONINVASIVE TREATMENT OF OCCLUSAL CARIES

For teeth with occlusal caries, there is a trend for selecting the most conservative technique with respect to saving sound tooth substance, preferring noninvasive to invasive techniques. Clinicians now have a much wider range of therapeutic options at their disposal for the management of occlusal caries.⁵ The choice of treatment is based on the diagnosis,^{26,27} and the accuracy of that diagnosis is of major importance.

A restorative approach is justified when an occlusal carious lesion has reached the dentin.^{21,23,24} Because it seems to be a general opinion that dentinal caries should be treated operatively, it is important to know the amount of dentin involved in an occlusal carious lesion without visible clinical cavitation.²⁸

When decisions are made about restorative care, the generally slow average progression rates reported have to be weighed against the likely durability of any restoration.¹⁸ There is evidence that the longevity of many restorations may be short. Traditional restorative dentistry is the worst alternative for treating incipient occlusal caries, suffering from a large number of failures. Recurrent caries can occur at the tooth-restoration interface, indicating that disease is present. The belief that dental caries can be treated effectively by restoring the lesion is an error. A decision to undertake invasive restorative treatment for a tooth may be appropriate only if, at the same time, noninvasive preventive measures are also applied.^{3,29}

Sound fissures or those with arrested lesions require no specific treatment. As a matter of fact, arrested lesions exhibit a higher degree of resistance to demineralization than do uninvolved areas.^{13,14} However, where fissure morphology conceals progressive, active enamel lesions, preventive techniques are required to arrest lesion progression.²⁷ Noninvasive preventive care is likely to be centered around counseling in oral hygiene, dietary matters, and the home use of topical agents such as fluoride toothpaste as well as possibly the application of fissure sealants.²⁹

Occlusal surfaces of erupting permanent molars are particularly susceptible to caries because conditions are favorable for plaque accumulation. An individualized, nonoperative treatment program can reduce dental plaque and caries on occlusal surfaces of newly erupted molars.^{30,31} The treatment program must be based on

the understanding of dental caries as a local disease and intensive training in home-based plaque control.

Special instructions about an appropriate technique for plaque control on the occlusal surfaces of partly erupted permanent molars must be given to the patient. He or she must be asked for intensive cooperation. The toothbrush is held in the buccolingual direction, with the bristles toward the occlusal surface, and moved with rotary motions.³⁰

Fluoride toothpastes must be used in conjunction with the daily toothbrushing, constituting at-home preventive care. At the dentist's office, the therapeutic use of fluorides can be conducted. So, the clinician can also reinforce the plaque control of the patient, emphasizing the necessity of consistent use of a fluoride toothpaste. The effectiveness of fluoride against caries is known, and the frequency of fluoride presence in the oral fluid is a strong factor in cariostasis. Improved methods of delivering low, but effective, levels of fluoride, either more frequently or over prolonged periods, are beneficial for the increased efficacy of fluoride against caries.³²

Another technique used by clinicians is "watchful waiting" or reevaluation at the next appointment. This technique may be combined with topical fluoride treatment and dietary counseling that could provide the opportunity for arrest of the lesion and remineralization and a return to a clinically sound state.⁸

Sealant is usually placed when an active enamel carious lesion shows signs of progression, when the patient presents high caries risk and cannot control the dental plaque efficiently by toothbrushing, or when the patient does not cooperate with the proposed treatment. Sealant is considered interceptive, rather than preventive, because the carious process in small lesions, and occasionally in larger lesions, may be arrested after sealing.^{25,33-37} If the sealant is maintained and the nutrients are prevented from entering in the fissure, there is a continual reduction in the viability of the remaining bacteria.³⁴

There appears to be some evidence of the effect caused by glass-ionomer cement on the consistency of remaining carious dentin.³⁵ However, it would be premature to conclude that complete removal of carious dentin need not be carried out when glass-ionomer cements are used. Although enamel caries can be arrested by the use of sealant, means of diagnosing occlusal caries are no less important.³⁷ Therefore, once the carious process has reached the point where bacteria have infected the dentin, removal of the infected tissue and its replacement with a restoration may be the treatment of choice.³⁸

In recent years, chlorhexidine has become available as varnishes and has already been shown capable of reducing *Streptococcus mutans* and demineralization

in several studies.³⁹⁻⁴³ *Streptococcus mutans* was suppressed in occlusal fissures for 2 months after one application of 40% chlorhexidine varnish.⁴³ The major advantages of its use seemed to be the lack of discoloration of teeth, the longer retention, and the absence of bad taste for the patient because of the local application in occlusal surfaces.

The use of fluoride varnishes in conjunction with an antimicrobial solution, such as 0.2% chlorhexidine gluconate, may enhance the remineralization of the affected enamel in the fissure in vitro.⁴⁴ Therefore, not only would the infection be controlled by the reduction of *Streptococcus mutans*, but also the structural loss caused by the carious lesion would be repaired.

From this range of noninvasive treatments, the professional can choose the best for the patient, associating compatible methods for specific cases, allied with health promotion.³¹ Once a noninvasive approach to one or more carious lesions in an individual has been adopted, continued vigilance will be required so that any progression of the caries can be monitored and managed accordingly.⁵ Furthermore, clinicians should be conscious of their diagnostic performance, adjusting their treatment philosophy to emphasize accurate diagnoses, resulting in fewer unnecessary restorations. Dentists who make the diagnosis and the treatment of caries fit the patient's risk will be rendering the best professional service.

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